THE COMBINATION OF CONTROL METHODS AS THE BEST MANNER TO CONTROL *TUTA ABSOLUTA* (Meyrick, 1917)

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ABSTRACT

Tomato is a very important vegetable crop used both for fresh consume and processing in Albania. It could be affected from various serious pests; recently the most devastating ones is *Tuta absoluta*. In accordance with climatic conditions of Albania *Tuta absoluta* gives four generations starting from March till July. In the lack of control measure, the percentage of damage caused by this pest on tomato in greenhouses and open-field can achieve very high level. In this context the integration of control measures is crucial to achieve successfully the controlling of this pest. Mass capture technique used alone does not guaranty a total effectiveness but it is necessary to be accompanied with other methods. Integrated Pest Management (IPM) program for controlling *Tuta absoluta* might be applied in different strategies including: mass trapping technique, light traps, insecticides as well as biological insecticide. In order to monitor the tomato moth *Tuta absoluta* in experimental area, 4 pheromone traps were installed. The delta traps were placed in the center of greenhouse less than 1 meter. Mass capture technique started immediately when the first adult insects were observed during the monitoring of pheromone lures. In this variant were placed 10 water traps with lure per 0.5 hectare. The products used for the treatment during the experiment are *Bacillus thuringiensis*, Azadirachtin, Spinosad and Indoxacarb. The objective of the study is to assess the effectiveness of different control methods.

Keywords: Tomato, *Tuta absoluta*, combine, control, methods, mass capture, insecticides.

INTRODUCTION

Tomato (*Lycopersicon esculentum*, Mill) is a very important vegetable crop used both for fresh consume and processing in Albania. It could be affected from various serious pests; recently the most devastating ones is *Tuta absoluta* [2]. In accordance with climatic conditions of Albania *Tuta absoluta* gives four generations starting from March till July [2, 3]. In the lack of control measure, the percentage of damage caused by this pest on tomato in greenhouses and open-field can achieve very high level [2, 3]. In this context the integration of control measures is crucial to achieve successfully the controlling of this pest [3, 4]. Mass capture technique used alone does not guaranty a total effectiveness but it is necessary to be accompanied with other methods [2, 5]. Integrated Pest Management (IPM) program for controlling *Tuta absoluta* might be applied in different strategies including: mass trapping technique, light traps, insecticides as well as biological insecticide [2, 5].

This moth is originated from South America. In Europe *Tuta absoluta* was initially reported from Eastern Spain in late 2006 [19, 13] and has subsequently spread throughout many European countries, including the Balkan and Mediterranean regions [8. 9, 7, 15, 13]. The

rapid distribution of *Tuta absoluta* over wide geographic areas may be a result of various factors such as its high biotic potential, the large range of its host plants (increasing its persistence in the cultivated areas and overwintering potential), the intra-continental dispersal facilitation due to human transportation and the artificial selection of insecticide-resistant populations [16, 1, 11, 17, 12]. Furthermore, the absence of co-evolved natural enemies may explain why the pest population dynamics in the newly invaded areas are faster than in the native area, where natural enemies are more frequent [7, 12].

Tuta absoluta is a very challenging pest to control due to its resistance to pesticide, feeding habit and high reproduction capacity, which in turn may lead to gene mutation. The use of chemical pesticides was once uses as a sole control method, but has been declining with time. The pest was reported to developed resistance to dozens of pesticides. *Tuta absoluta* are well controlled by a combination of practices that are not fully effective when used alone. Various control strategy could applied to control leaf miners. To control the pest effectively it is critical to combine all available control measures including physical methods, cultural methods, biological control agents and the correct use of registered pesticides [16, 14, 10, 12]. IPM strategies are being developed in South America to control *Tuta absoluta*. Various active substances can be applied in combination with bio rational control tactics [18, 6, 16]. The integrated control method recommended employs, massive trapping before planting, clearing the soil of crop residues, the application of Imidacloprid in the irrigation water 8-10 days after planting, the application of either Spinosad or Indoxacarb if occasional individuals of *Tuta absoluta* are observed and elimination of the remnants of the crop immediately after the last fruits have been harvested [18, 6, 16].

The objective of the study is to assess the effectiveness of different control methods.

METHODOLOGY

The experiment was carried out during 2014-2016, in low coastal area. The greenhouse allocated in Sukth was covered with glasses and had a surface of 2 hectare. The experiment was developed in the first culture of the planted tomatoes. The experimental scheme was divided into 4 variants with an area of 0.5 hectare. In order to monitor the tomato moth *Tuta absoluta* in experimental area, 4 pheromone traps were installed. The delta traps were placed in the center of the greenhouse less than 1 meter. Traps were checked once per week. The flies counting and their monitoring into pheromone were performed on regular weekly basis intervals. The pheromones were changed after 4 weeks. In our experiment conditions used pheromone lures coupled with Delta traps (0.5 mg E3Z8Z11-14Ac, 0.024 mg E3Z8-14Ac) Product Code PH-937-1RR [20]. Mass capture technique started immediately when the first adult insects were observed during the monitoring of pheromone lures. In this variant were placed 10 water traps with lure in 0.5 hectare. They were placed 25 meter away from each other.

The products used for the treatment during the experiment - 1) *Bacillus thuringiensis* variety Kurstaki: In each plot separate 10 plants and are treated with *Bacillus thuringiensis* var. Kurstaki, the dosage of *Bacillus thuriengensis* was 100 gram per 100 liter water. For each generation the first treatment is done 4-5 days after the flies' period and second one 8-10 days after the first treatment. 2) Indoxacarb: In each plot 10 plants are treated with Avaunt 15 EC (Indoxacarb). The dosage of Indoxacarb was 25 gram per 100 liter water. For each generation are done two treatments as per the above dosage with intervals application 14 days. Time of intervention with Avaunt 15 EC (Indoxacarb) in our experimental is based on economical

threshold 2 females per plant. 3) Azadirachtin: In each plot 10 plants are treated with Neem Azal S/T 0.3%. The dosage was 300 gram per 100 liter water. For each generation is done one treatment, and after 14 days is done the assessment of effectiveness. Time of intervention is based on economical threshold 30 adult catches per week. 4). Spinosad: In each plot 10 plants are treated with Laser 480 SC (Spinosad). The dosage of Spinosad was 25 gram per 100 liter water. For each generation are done two treatments as per the above dosage with intervals application 14 days. Time of intervention with Laser 480 SC (Spinosad) is based on economical threshold 2 females per plant. 5). Emamectin benzoate: In each plot 10 plants are treated with AFFIRM 095 SG. The dosage of emamectin was 150 gram per 100 liter water. Fruits and leaves are analyzed 7 days after second treatment to assess the technical effectively of insecticide used.

RESULTS AND DISCUSSION

The tomato plants give high potential yield in our farm conditions, both in open field and in protected area (glasshouses) too [2, 3]. In the experimental field, in tomato plants there are the primary pest and secondary one. The presence of primer pest per each year is upper economical threshold [2, 3]. Controlling those pests needs a lot of plant protection products. In this context, the usage of chemical compounds by the farmers does not guaranty a high level of control [2, 4]. The monitoring technique is a basic element to determine the correct timing for insecticide applications leading to a reduction and to implement mass capture [2, 3].

- The results of the experiment (2014 - 2016) for the mass capture technique which started immediately when the first adult insects were observed during the monitoring of pheromone lures shows that this technique has an efficiency about 50% - 71% in leaves and 52% - 72% in fruits. In these circumstances, we conclude that this technique used alone does not guarantee a maximum effectiveness (100%), but need to be combined with other methods.
- Among other accompanying methods is mentioned the treatment with *Bacillus thuringiensis* varieties Kurstaki in the first stage of larvae, to control *Tuta absoluta.* The effectiveness of treatment with *Bacillus thuringiensis* varieties Kurstaki varies from 50% to 71% on leaves and from 52% to 72% on fruits.

- Indoxacarb is also another useful chemical compound for controlling *Tuta absoluta* in the protected area always combined with the mass capture technique to ensure maximum effectiveness. Following performed treatments, the effectiveness of Indoxacarb varies from 45% to 64% on leaves and from 41% to 58% on fruits.

- Spinosad is another good alternative for controlling *Tuta absoluta* in our farm conditions. It is a highly selective environmentally-friendly bio-insecticide [5]. Its effectiveness varies from 44% - 67% in leaves and from and 39% - 60% in fruits. Spinosad used alone does not give a very high technical effect on the larvae of *Tuta absoluta*. It does not give a full protection of the tomato fruits and leaves [5]. Using Spinosad does not guaranty a total effectiveness for controlling of *Tuta absoluta*. It should be combined with other methods and especially with mass capture technique [5].

- The usage of azadirachtin is a useful alternative in context of integration control measures for reduction of dynamic population of *Tuta absoluta* on tomato plant [4]. Using azadirachtin as a highly selective and environmentally-friendly insecticide and integreted it in the control measure of *Tuta absoluta* was an important step of our experiment [4]. Its effectiveness varies from 68% to 74% in leaves and from 73% to 81% in fruits for first and second instars,

and 58% to 64% in leaves and 54% to 71% in fruits for third and fourth instars. Azadirachtin is much more effective to be used for controlling the larva 1st and 2nd instars. The treatment against for 3rd and 4th instars azadirachtin is less effective. During the first days of the treatment the effectiveness is low, and after that start to be increased, and achieve the maximum 14 days after treatments [4].

- The Emamectin benzoate pesticide is a useful alternative for controlling *Tuta absoluta* because such pesticide does not show resistance and has a very high control against *Tuta absoluta* [2]. Its effectiveness varies from 86% to 90% in leaves and from 86% to 91% in fruits. *Tuta absoluta* is a very harmful insect for tomato plants in Albania climatic condition, so using Emamectin benzoate based on experimental results in our farm is a new alternative to control it [2], but to ensure maximum effectiveness need to be combine with mass capture technique.

CONCLUSIONS

The general conclusion of the experiment is that all the methods used alone do not guarantee an overall effect but need to be combined to give a high effectiveness and full protection of tomato fruits and leaves.

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